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Engineers model chemical laser performance

by Barbara Baca, Directed Energy Directorate

KIRTLAND AFB, N.M. — The Airborne Laser is a 747-400 aircraft armed with a chemical laser designed to destroy theatre ballistic missiles. Although the plane will not be operational for a few years, the laser itself is being tested, in-part, through modeling and simulation techniques, here, by the Air Force Research Laboratory's Directed Energy Directorate.

The directorate's computer simulation techniques are working in conjunction with actual laser tests being conducted by TRW in their southern California facilities. This cooperation will ensure the successful demonstration of the first flight laser module next year. Both methods of testing are essential. By using computer technologies first, the lab is able to better create testing procedures, thus cutting out testing time and hardware.

The chemical oxygen-iodine laser used for the Airborne Laser is being modeled by AFRL to predict the advanced performance concepts for potential use in the next generation Airborne Laser. These tests are being conducted by a team consisting of Logicon, Inc., the Scientific Research Associates, and the High Power Gas and Chemical Laser Branch of the Directed Energy Directorate.

The tests will explain, with the use of mathematical equations, exactly what is happening within the laser.

"There are many things within the laser to consider," said Dr. Timothy Madden, a scientist in the laboratory's High Power Gas and Chemical Laser Branch.

"We are using computer technologies to describe what's happening within the laser such as chemistry, gases, and optical physics. Through modeling and simulation, we will save the government from having to purchase extra hardware and from paying for extended testing time," he added.

The project, entitled 3-D Computational Fluid Dynamic Modeling of the Chemical Oxygen-Iodine Laser, has been ongoing since 1993. Logicon Inc. has been providing modeling development and support since the beginning. Their primary business is to provide scientific and engineering support.

RDA/Logicon Inc., in conjunction with Scientific Research Associates, has been developing a 3-D model for the laser under AFRL funding. It is this model that is currently being used to simulate the laser used in the Airborne Laser.

Dr. Madden is the principal investigator with the project and performs 3-D simulations using another model, built upon a computer code developed by Aerosoft, Inc. of Blacksburg, Va.

"The Research Lab also funded a second effort - my doctorate work specializing in 3-D COIL simulation. Essentially, my presence here is a return on the Air Force's investment in my education and training," Madden said.

The laboratory is also working in support of the Airborne Laser with the Department of Defense High Performance Computing Monitorization Program. This program is designed to provide the United States military with a technological advantage to support warfighting requirements. It also provides DoD with advanced hardware, computing tools and training to researchers using the latest technology to aid in their mission - the testing of the Chemical Oxygen-Iodine Laser. **@**